ESOT ECTORS 3rd MEETING
29-30 September 2022
ROTTERDAM
The Netherlands
#ESOT_ECTORS #ECTORSmeeting

Organ Viability Assessment with Imaging Measurement Technology during Machine Perfusion for porcine DCD liver

Hiromichi Obara[1,2,4], Y. Okazawa[1], T. Nakajo[2],T. Kaneko[2], H. Bochimoto[3] ,X. Li[4], N. Matsuno[1,2,4]
[1]Tokyo Metropolitan University, Tokyo, Japan, [2]Asahikawa Medical University, Hokkaido, Japan
[3]The Jikei Medical University; Tokyo, Japan, [4]National Center for Child Health and Development;Tokyo,Japan

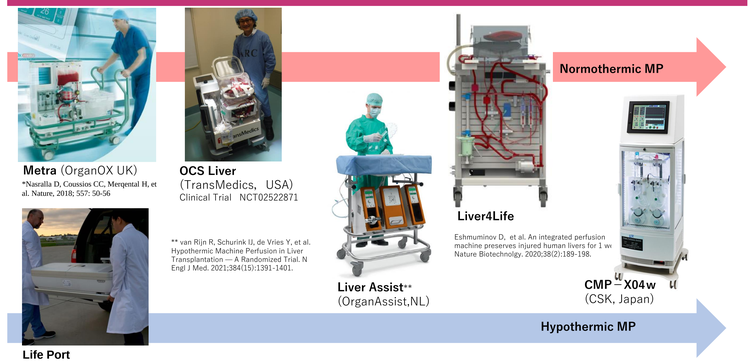
CONTACT:
obara@tmu.ac.jp

TOKYO METROPOLITAN UNIVERSITY

INTRODUCTION

A machine perfusion is a promising strategy to preserve organs donated after cardiac death (DCD). It provides some opportunities to preserve, improve and assess the graft viability prior to transplantation. The assessment methods for graft viability during machine perfusion are important to extend the donor criteria and the total number for transplantation.

Liver Machine Perfusion



Metra (OrganOX UK)
*Nasralla D, Coussios CC, Mergental H, et al. Nature, 2018; 557: 50-56

OCS Liver
(TransMedics, USA)
Clinical Trial NCT02522871

** van Rijn R, Schurink IJ, de Vries Y, et al. Hypothermic Machine Perfusion in Liver Transplantation — A Randomized Trial. N Engl J Med. 2021;384(15):1391-1401.

Liver Assist**
(OrganAssist,NL)

Liver4Life
Eshmuminov D, et al. An integrated perfusion machine preserves injured human livers for 1 wk Nature Biotechnolgy. 2020;38(2):189-198.

CMP－X04w
(CSK, Japan)

Life Port
(Organ Recovery, USA)

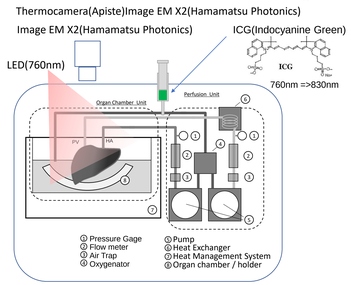
Preserve organ function

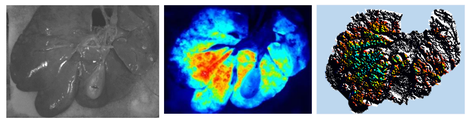
Viability assessment

Organ Repair

METHOD

Pigs were employed to harvest a liver graft under several warm ischemic time conditions. The system for machine perfusion was consisted of a highspeed thermal camera to measure temperature distributions of the organ and a high sense camera for near infrared to detect ICG florescent dynamics. We perfused porcine livers injected ICG through the portal vein during perfusion under hypothermic, subnormothermic and normothermic conditions. The fluorescence image measurements were analysed to evaluate the flow and metabolism in the organs..





(a)Raw Image (b) ICG Image (c) Analyze

RESULTS

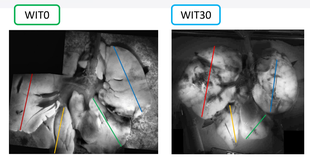


Fig ICG Images(WIT0,30)

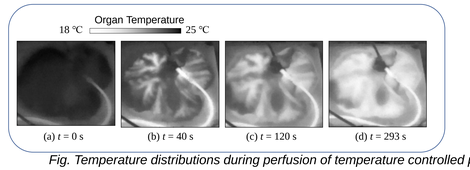


Fig. Temperature distributions during perfusion of temperature controlled perfusate

As an example, results from ICG are described here. In the images taken 180 sec after the addition of ICG, different fluorescence dynamics were observed depending on the individual. In particular, the fluorescence area and the intensity of fluorescence differ greatly between the experimental conditions, indicating the differences in the flow conditions. After 300 sec, the fluorescence spread in all livers, and the concentration diffusion of fluorescence intensity spread from capillaries to the tissues was observed.

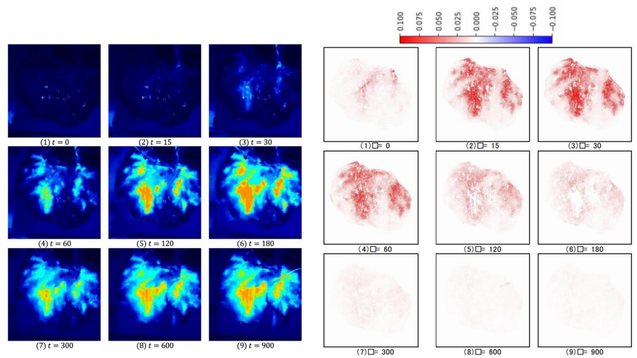


Fig Analyzed ICG Images(Sample b)

Fig Calculated ICG Images(Sample b)

AIM

In this study, we suggest novel imaging measurement technology with thermal and infrared cameras to investigate distribution of the ischemic injury part to predict organ qualities.

REFERENCES

(1) van Rijn R, Schurink IJ, de Vries Y, et al. Hypothermic Machine Perfusion in Liver Transplantation —
A Randomized Trial. N Engl J Med. 2021;384(15):1391-1401.

(2) Eshmuminov D, et al. An integrated perfusion machine preserves injured human livers for 1 week. Nature Biotechnolgy. 2020;38(2):189-198.

CONCLUSIONS

The potential of imaging measurement technology was presented for improvement of the machine perfusion and regenerative medicine.

ACKNOWLEDGEMENT

This researches is supported by KAKENHI and JKA. We appreciate contributions for experiment and computer analysis conducted by Mr.M. Futakata and Mr. Y.Sato.